

# Cloud Physics Lidar (CPL)

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The Cloud Physics Lidar, or CPL, is a backscatter lidar designed to operate simultaneously at 3 wavelengths: 1064, 532, and 355 nm. The purpose of the CPL is to provide multi-wavelength measurements of cirrus, subvisual cirrus, and aerosols with high temporal and spatial resolution. Figure 1 shows the entire CPL package in flight configuration. The CPL utilizes state-of-the-art technology with a high repetition rate, low pulse energy laser and photon-counting detection. Vertical resolution of the CPL measurements is fixed at 30 m; horizontal resolution can vary but is typically about 200 m. Primary instrument parameters are listed in Table 1. The CPL fundamentally measures range-resolved profiles of volume 180-degree backscatter coefficients. From the fundamental measurement, various data products are derived, including: time-height cross-section images; cloud and aerosol layer boundaries; optical depth for clouds, aerosol layers, and planetary boundary layer (PBL); and extinction profiles.

The CPL was designed to fly on the NASA ER-2 aircraft but is adaptable to other platforms. Because the ER-2 typically flies at about 65,000 feet (20 km), onboard instruments are above 94% of the earth's atmosphere, allowing ER-2 instruments to function as spaceborne instrument simulators. The ER-2 provides a unique platform for atmospheric profiling, particularly for active remote sensing instruments such as lidar, because the spatial coverage attainable by the ER-2 permits studies of aerosol properties across wide regions. Lidar profiling from the ER-2 platform is especially valuable because the cloud height structure, up to the limit of signal attenuation, is unambiguously measured.



FIG 1 – CPL INSTRUMENT PACKAGE, SHOWN MOUNTED IN ER-2 INTERFACE FRAME.

The fundamental CPL data product is a time-height cross-section image of the atmosphere, as illustrated in Figure 2. To-date the CPL has participated in numerous field campaigns, including SAFARI-2000, CRYSTAL-FACE, TX-2002, THORPEX, and TC-4.

*More information on CPL can be found at the CPL web site: <http://cpl.gsfc.nasa.gov>*

TABLE 1. CPL INSTRUMENT SPECIFICATIONS

Wavelengths	1064, 532, 355 nm
Laser type	solid state Nd:YVO4
Laser repetition rate	5 kHz
Laser output energy	50 $\mu$ J at 1064 nm 25 $\mu$ J at 532 nm 50 $\mu$ J at 355 nm
Telescope	20 cm diameter, off-axis parabola
Telescope field of view	100 microradians, full angle
Raw data resolution	1/10 second (30 m by 20 m horizontal)
Processed data resolution	1 second (30 m by 200 m horizontal)

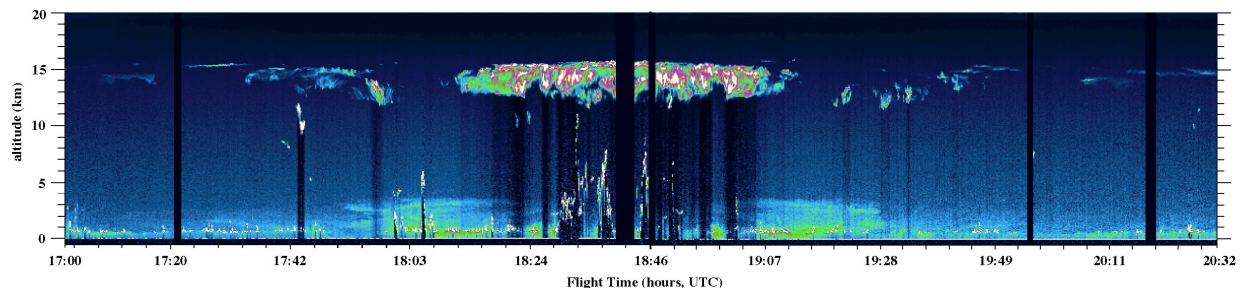


FIG 2 – EXAMPLE OF CPL DATA. THIS IMAGE SHOWS PROFILES OF 532 nm ATTENUATED BACKSCATTER FROM JULY 26, 2002. THIS IMAGE IS REPRESENTATIVE OF AIRBORNE LIDAR DATA, SHOWING CLOUD HEIGHT AND INTERNAL STRUCTURE AND BOUNDARY LAYER AEROSOL. IN ADDITION, A PERIOD OF ELEVATED AEROSOL, KNOW TO BE SAHARN DUST, IS EVIDENT IN THE MIDDLE OF THE TIME PERIOD.